

**REMARKS****Correction of Office Action Summary Sheet**

In response to the August 8, 2006 Office Action, Applicants respectfully submit that claims 1, 4-7, 9, 11-14, 39 and 40-43 are currently pending in this application, not claims 1-8, 12, 14, 39 and 40 as cited by the Examiner on the Office Action Summary. Applicants respectfully request the Examiner acknowledge same.

**Request for Rejoinder Reminder**

Applicants respectfully request rejoinder of method claims 17, 20-25, 27, 29-31, 33 and 35-38 upon allowance of the composition claims 1, 4-7, 9, 11-14, 39 and 40-42.<sup>1</sup> Towards that end, withdrawn method claim 17 has been amended in a manner consistent with the pending composition claims.

**New Claims 41-43**

Support for new claim 41 and 42 can be found in original claims 2 and 3, respectively.

Support for new claim 43 can be found in the instant specification at paragraphs [0003] and [0006].

**Objection Under 35 U.S.C. §132(a) - Specification**

1. In the August 8, 2006 Office Action, the Examiner objected to the amendment filed on May 15, 2006 under 35 U.S.C. §132(a). According to the Examiner, the amendment "...introduces new matter into the disclosure" not supported by the specification including:

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<sup>1</sup> Rejoinder was previously requested in the response to the June 9, 2005 Office Action, filed June 15, 2005, the response to the August 24, 2005 Office Action, filed November 23, 2005, and the response to the February 13, 2006 Office Action, filed May 15, 2006.

“A sacrificial silicon-containing layer etching composition consisting essentially of and consisting of supercritical CO<sub>2</sub>, at least one co-solvent, and at least one bifluoride compound selected from the group consisting of ammonium bifluoride and tetraalkylammonium bifluoride ((R)<sub>4</sub>NHF<sub>2</sub>), wherein R is methyl, ethyl, butyl, phenyl, or fluorinated C2-C4 alkyl groups.” (see the August 8, 2006 Office Action, page 2, lines 4-8)

Applicants traverse this objection and respectfully submit that this 35 U.S.C. §132(a) objection is improper.

The CCPA previously explained the difference between a new matter rejection under Section 132 and a lack of adequate written description under Section 112, first paragraph. Specifically, the court recited:

“Broadening a claim does not add new matter to the disclosure. Disclosure is that which is taught, not that which is claimed. An applicant is entitled to claim [sic] as broad as the prior art and his disclosure will allow. The proper basis for rejection [sic] of a claim amended to recite elements thought to be without support in the original disclosure, therefore, is Section 112, first paragraph, not section 132. The latter section prohibits the addition of new matter to the original disclosure. It is properly employed as a basis for objection to amendments to the abstract, specifications, or drawings attempting to add new disclosure to that originally presented.” *In re Rasmussen*, 650 F.2d 1212, 211 USPQ 323, 326 (C.C.P.A. 1981); see also M.P.E.P. §2163.06.

In the present case, Applicants have added two new claims relating to “a sacrificial silicon-containing layer etching composition consisting of or consisting essentially of supercritical CO<sub>2</sub> (SCCO<sub>2</sub>), at least one co-solvent, and at least one bifluoride compound selected from the group consisting of ammonium bifluoride and tetraalkylammonium bifluoride ((R)<sub>4</sub>NHF<sub>2</sub>), wherein R is methyl, ethyl, butyl, phenyl or fluorinated C<sub>1</sub>-C<sub>4</sub> alkyl groups” (see new claims 39 and 40). No amendments or additions have been made to the abstract, specification, or drawings attempting to add new disclosure to the original application. Accordingly, the objection under 35 U.S.C. §132(a) is improper.

Applicants respectfully request that the Examiner withdraw the stated 35 U.S.C. §132(a) objection.

**Rejection of Claims on Reference Grounds, and Transversal Thereof**

In the August 8, 2006 Office Action:

claims 1-7, 9, 11, 12, 14, 39 and 40 were rejected under 35 U.S.C. §112, first paragraph;

claims 1-7, 9, 11-12, 14, and 39-40 were rejected under 35 U.S.C. §103(a) as being unpatentable over Vaartstra (U.S. Patent No. 6,149,828) in view of Mullee (U.S. Patent No. 6,306,564); and

claims 11 and 12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Vaartstra in view of Mullee and further in view of Wilkinson et al. (U.S. Patent No. 5,789,505); and

claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Vaartstra in view of Mullee and further in view of Wilkenson, as applied to claim 1 above.

These rejections are respectfully traversed. The patentable distinctions of the pending claims over the cited references are set out in the ensuing discussion.

**Rejection of Claims 1-7, 9, 11, 12, 14, 39 and 40 Under 35 U.S.C. §112, First Paragraph**

In the August 8, 2006 Office Action, claims 1-7, 9, 11, 12, 14, 39 and 40 were rejected under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement. According to the Examiner, the claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner asserts:

“...the specification broadly discloses a supercritical supercritical [sic] etchant formulation that consists or consists essentially of a supercritical fluid, at least one co-solvent, and at least one etchant, and at least one optionally [sic] surfactant [0024], the Specification fails to show an etching composition that consists of the combination or supercritical CO<sub>2</sub>, at least on [sic] co-solvent and at least one bifluoride selected from the group consisting of one bifluoride compound selected, as recited

in claim 39. The Specification fails to show an etching composition that consists essentially the same, as recited in claim 40.”

Applicants respectfully traverse this rejection.

It is initially noted that claims 2-3 were cancelled in response to the February 13, 2006 Office Action as filed on May 15, 2006. As such the rejection of claims 2 and 3 herein is moot. Furthermore, it is unclear why claims 1, 4-7, 9, 11, 12 and 14 were rejected as the rejection focuses exclusively on claims 39 and 40.

The Examiner is respectfully reminded that to satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention at the time of filing. MPEP §2163 (I) (citing *Vas-Cath, Inc. v. Mahurkar*, 19 U.S.P.Q.2d 1111, 1116 (Fed. Cir. 1991)). Original claims themselves are adequate written description of the claimed invention, for example as stated by the Court in *In re Gardner*:

Under these circumstances, we consider the original claim in itself adequate “written description” of the claimed invention. It was equally a “written description” whether located among the original claims or in the descriptive part of the specification (*In re Gardner*, 480 F.2d 879, 178 USPQ 149 (C.C.P.A. 1973)).

Furthermore, each claim must be given its broadest reasonable interpretation in light of and consistent with the written description. MPEP §2163 (II)(A)(1) (citing, e.g., *In re Morris*, 44 U.S.P.Q.2d 1023, 1027 (Fed. Cir. 1997)).

Turning to the present case, support for pending claim 1 can be found throughout the specification and original claims as filed. Claim 1, as originally filed, recites:

**“A sacrificial silicon-containing layer etching composition, comprising a supercritical fluid (SCF), at least one co-solvent, at least one etchant species, and optionally at least one surfactant.”**

Original claim 8 recites:

**“The composition of claim 7, wherein the etchant species comprises at least one bifluoride compound selected from the group consisting of ammonium bifluoride and tetraalkylammonium bifluoride ((R)<sub>4</sub>NHF<sub>2</sub>), wherein R is a C<sub>1</sub>-C<sub>4</sub> alkyl group.”**

Original claim 10 recites:

**“The composition of claim 7, wherein the surfactant comprises at least one nonionic surfactant.”**

The incorporation of each of claims 8, and 10, including relevant language from any intervening claims, results in claim 1 as presently pending.

**“A sacrificial silicon-containing layer etching composition, comprising a supercritical fluid (SCF), at least one co-solvent, at least one etchant species, and at least one non-ionic surfactant, wherein the etchant species comprises at least one bifluoride compound selected from the group consisting of ammonium bifluoride and tetraalkylammonium bifluoride ((R)<sub>4</sub>NHF<sub>2</sub>), wherein R is a C<sub>1</sub>-C<sub>4</sub> alkyl group.”**

As such, considering claim 1 reasonably and broadly in light of and consistent with the written description (including the original claims), it is described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors at the time the application was filed, had possession of the claimed invention.

With regards to claims 39 and 40, paragraph [0023] of the instant specification recites:

**“In the broad practice of the invention, the SCF-based etching formulations may comprise, consist of, or consist essentially of a SCF, at least one co-solvent, at least one etchant and optionally at least one surfactant.”**

The etchant is specifically defined in the application and claim 8 as comprising at least one bifluoride compound selected from the group consisting of ammonium bifluoride and

tetraalkylammonium bifluoride ((R)<sub>4</sub>NHF<sub>2</sub>), wherein R is a C<sub>1</sub>-C<sub>4</sub> alkyl group. As indicated hereinabove, claims 39 and 40 must be interpreted broadly and reasonably in light of and consistent with the written description. Accordingly, claims 39 and 40 are described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors at the time the application was filed, had possession of the claimed invention.

Applicants respectfully request that the Examiner withdraw the stated 35 U.S.C. §112, first paragraph rejection.

### **Rejections under 35 U.S.C. §103(a)**

1. In the August, 8, 2006 Office action, claims 1-7, 9, 11-12, 14, and 39-40 were rejected under 35 U.S.C. §103(a) as being unpatentable over Vaartstra (U.S. Patent No. 6,149,828) in view of Mullee (U.S. Patent No. 6,306,564). Applicants traverse such rejection.

The Examiner is respectfully reminded that “teachings of references can be combined only if there is some suggestion or incentive to do so.” *In re fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988) (quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984)) (emphasis in original). The Examiner can satisfy the burden of showing obviousness of the combination “only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references” *In re French*, 23 U.S.P.Q.2d 1780, 1783 (Fed. Cir. 1992) (emphasis added).

Furthermore, prior art references must be considered as a whole. *W.L. Gore and Associates, Inc., v. Garlock, Inc.*, 220 U.S.P.Q. 303 (Fed. Cir. 1993), *cert. denied*, 469 U.S. 851 (1984). Thus, the Examiner may not import specific elements from one reference into another reference, while choosing to ignore other essential features or teachings of the cited references.

Turning to the present case, Applicants point out that Vaartstra teaches the etching of an inorganic material from a semiconductor-based structure while Mullee teaches the removal of an organic material from a silicon-based substrate. These methods deal with the removal of

material from two very distinct and separate chemical classes, so distinct in fact, that these classes are taught as separate courses in college.

Importantly, the Examiner has acknowledged this distinction by stating that Vaartstra “teaches exposing a substrate to a supercritical etching composition to remove inorganic material that includes silicon and silicon dioxide...” (see August 8, 2006 Office Action at page 4, lines 11-15) and that Mullee teaches “...a stripping chemical comprising CO<sub>2</sub>... or isopropanol, which may be used independently or added to remove organic contaminants from a wafer surface...” (see August 8, 2006 Office Action at page 6, lines 7-13).

Applicants question where is the objective teaching in the prior art or the knowledge of one skilled in the art to combine the Vaartstra teaching, which relates to the removal of inorganic material, and the Mullee teaching, which relates to the removal of organic material? Accordingly to the Examiner, the alleged motivation to combine is as follows:

“it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Vaartstra’s composition by employing alcohols as specified by and ammonium biftuoride as taught by Mullee because using ammonium biftuoride along with organic and/or inorganic stripping solvent(s) supported by supercritical CO<sub>2</sub> is known to effect the removal of contaminants from a wafer surface (Mullee, column 1, lines 9-14).” (see August 8, 2006 Office Action at page 6, lines 14-19) (emphasis added)

Notably, this argument is incorrect - Mullee states that supercritical CO<sub>2</sub> is known to effect the removal of organic contaminants from a wafer surface, not any contaminant. For example, applicants direct the Examiner’s attention to Mullee, column 1, lines 8-13, which clearly states:

“This invention relates to stripping semiconductor wafers and, in particular, to using a chemical, such as organic and/or inorganic stripping solvent(s), supported by supercritical CO<sub>2</sub>, to remove resist material, such as photoresist,<sup>2</sup> its residue, and/or an organic contaminant, from the surface of semiconductor device on the wafer.” (emphasis added)

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<sup>2</sup> photoresist is a well known organic material and as such, its residue will include organic material

Considered *in toto*, there is no motivation, teaching or suggestion in either Vaartstra and Mullee to combine the two mutually exclusive teachings.

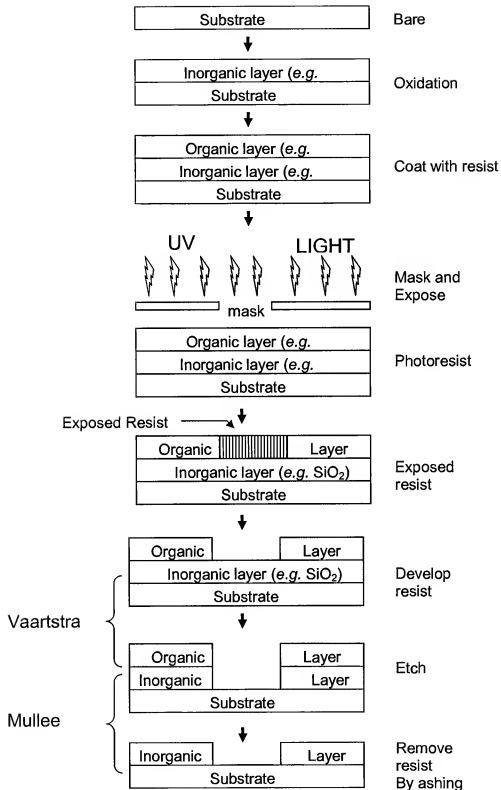
Furthermore, it is well established that if the combination of Vaartstra and Mullee renders either reference unsatisfactory for its intended purpose, a *prima facie* case of obviousness does not exist (see, *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

The intended purpose of Vaartstra is a method for etching an inorganic material (e.g., SiO<sub>2</sub>) from a semiconductor-based substrate using a supercritical etching composition. Mullee relates to a method of stripping photoresist, photoresist residue, or other organic contaminants from the surface of semiconductor substrate using supercritical CO<sub>2</sub> and other inorganic or organic solvents (see, for example, col. 1, lines 8-13 and col. 1, lines 31-34). Importantly, the removal of organic components, such as photoresist and its residue, from a semiconductor surface and the removal of inorganic material, such as SiO<sub>2</sub>, are separate and distinct steps in the photolithography process. Briefly, photolithography is a process whereby a pattern representing the circuit components of an integrated circuit are transferred from a mask to the surface of the substrate. As shown in Fig. 1, a substrate including an inorganic layer such as SiO<sub>2</sub> is coated with a light sensitive organic material (i.e., photoresist). In the next step, a mask is positioned above the substrate and ultraviolet light is flashed through the mask onto the wafer thereby exposing the organic photoresist material. The exposed organic material is thereafter developed, i.e., dissolved, thereby exposing the inorganic layer below.<sup>3</sup> In the next step, the inorganic material is etched away, using methods such as that described by Vaartstra, leaving the pattern of the mask now on the Si wafer. Finally, the protective resist is removed, using methods such as those described by Mullee. The patterning process can be repeated several times during the wafer processing steps.

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<sup>3</sup> this is an example of positive photoresist.





**Fig. 1: Overview of Photolithography**

Clearly, Vaartstra would be rendered unsatisfactory for its intended purpose if Vaartstra and Mullee were combined (although there is no motivation or suggestion to combine the two references). By importing the method of Mullee, the method of Vaartstra would not only etch away the *inorganic* material, but also the *organic* material found on the substrate. As such, following the combined Vaartstra/Mullee method, both the inorganic and organic material would be removed from the substrate at the same time, thus destroying the very pattern that was created during the photolithography process. Clearly this result is not one intended by either Vaartstra or Mullee, nor would one skilled in the art opt to use such a combination with such potentially disastrous results.

In conclusion, since there is no motivation, teaching or suggestion to combine Vaartstra or Mullee, there is no reasonable expectation of success upon such combination and because Vaartstra and Mullee would be rendered unsatisfactory for their intended purposes, applicants request withdrawal of the objection of claims 1-7, 9, 11-12, 14, and 39-40 under 35 U.S.C. §103(a) over Vaartstra and Mullee.

2. In the August 8, 2006 Office Action, claims 11-13 were rejected under 35 U.S.C. §103(a) as being unpatentable over Vaartstra in view of Mullee and further in view of Wilkinson et al. (U.S. Patent No. 5,789,505) (hereinafter Wilkinson). Applicants traverse such rejection.

Wilkinson relates to the use of surfactants in applications using liquid/supercritical CO<sub>2</sub>.

As discussed hereinabove, the combination of Vaartstra and Mullee does not make obvious applicants' claimed invention. The inclusion of Wilkinson does not cure this deficiency. In fact, Wilkinson has been cited merely to modify the surfactant disclosed in Vaartstra, as stated by the Examiner (see the August 8, 2006 Office Action, paragraph bridging pages 9 and 10). As such, applicants' claimed invention remains non-obvious in view of Vaartstra, Mullee and Wilkinson.

Accordingly, applicants respectfully request withdrawal of the rejection of claims 11-13 under §103 in view of Vaartstra, Mullee and Wilkinson.

3. In the August 8, 2006 Office Action, the Examiner noted that (1) claim 46 is indefinite because the claim language "wherein the etchant gas contain  $C_4F_8$ " fails to conform to the language of "etchant gas consisting essentially of as recited in claim 41; (2) claim 57 is indefinite because " $C_{2n}F$  gases" is unclear and unknown and " $CH_4$ " is not commensurating in scope with "an etchant gas consisting essentially of...as recited in independent claim 53; and (3) claim 58 is indefinite because the claim language "wherein the etchant gas contains  $C_4F_8$ " fails to conform to the language of "...etchant gas consisting essentially of" as recited in claim 53 (see August 8, 2006 Office Action, page 5, line 17 through page 6, line 5). Applicants submit that claims 1, 4-7, 9, 11-14, 39 and 40 are currently pending. Applicants respectfully request the Examiner clarify to which claims are being referred.

#### **Fees Payable**

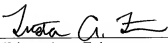
Three (3) dependent claims have been added herein. As such, a claims fee of ( $3 \times \$50.00$ ) = \$150.00 is due.

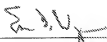
The total fee of \$150.00 is being paid by Electronic Funds Transfer. Authorization is hereby given to charge any deficiency in applicable fees for this response to Deposit Account No. 13-4365 of Moore & Van Allen PLLC.

#### **Conclusion**

Based on the foregoing, claims 1, 4-7, 9, 11-14, 39 and 40-43 are in form and condition for allowance. If any additional issues remain, the Examiner is requested to contact the undersigned attorney at (919) 286-8090 to discuss same.

Respectfully submitted

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